The Role of Rural Electrification in Promoting Health in South Africa

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Executive Summary

Overview

There has been substantial disagreement over the role and importance of rural electrification in rural development. This paper provides a critical overview of the link between health and electrification in rural areas. The paper then examines how the South African government envisages rural health promotion. It gives a brief overview of relations between electricity and health services, and provides a critical context to the role of energy within the range of health services to be offered in rural areas of South Africa.

Objectives

The study aimed to explore the potential of rural electrification in the provision of health in rural areas of South Africa. A critical analysis of the literature on rural electrification was undertaken with the objective of ascertaining the relationship between health and electrification.

Approach

A review of literature on rural electrification, health and ill-health was conducted. Literature pertaining to the health status of rural residents in South Africa was reviewed, as were the health documents produced by the African National Congress and the Department of Health. Informal interviews were conducted with representatives of Eskom, the Department of Health in KwaZulu-Natal and the Northern Province, the Department of Water Affairs, the Independent Development Trust (IDT), and the Energy and Development Group.

Results

The literature review suggested that while the relationship between rural electrification and improved health is complex and not direct, electrification nevertheless could play an important role in the improvement of health of people living in rural areas. Some of the most important findings are summarised below:

- Energy plays an indirect role in health production, but some energy sources are directly implicated in ill-health, and electrification could substantially reduce the occurrence of ill-health as a result of inadequate energy sources.
- Where houses are electrified, there are likely to be disparities in benefit, and these are likely to accrue to the richer sectors of the population.
- Nevertheless, long-term health benefits could accrue from rural electrification where it is part of a coherent and carefully designed development programme, and where conversion to electricity is complete.
- The study found that the Department of Health's vision for health will be provided through rural clinics.
- Clinics are usually built by the IDT and stocked by the Department. The process of clinic-building differs from province to province.
- It is clear that in the current South African context, formalised interaction between key role-players among the institutions involved in the provision of health services is not driven by a cohesive planning programme that prioritises specific kinds of health intervention and services to be offered to rural dwellers.
- The research suggests that while clinics are important in curative interventions, electrification is likely to have a more beneficial role in promoting health where householders have access to domestic electricity.
- The research also suggests that while electricity is an important factor in the provision of health through services such as clinics, there are a host of intervening factors that determine the extent of its value.
- A case study of the vaccination cold-chain illustrates the above finding, demonstrating that while a reliable energy source is important in keeping vaccines at the required temperatures, parental behaviours, nurses behaviours, the reliability and performance of fridges are equally important in determining the efficacy of a vaccination programme.

- The study concludes that over the long term electrification can have both direct and indirect health benefits, when implemented as part of a co-ordinated, sustained, community-based programme of rural development.
- Given that the White Paper on Health has yet to be passed into law, a further recommendation that flows from this report is that future research be undertaken to examine the effects of the Act on health planning and service provision.

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1 Introduction

There is substantial disagreement over the role and importance of rural electrification (RE) in rural development (see analyses contained in, among others, Davis, 1995; Ramani, 1992; Ranganathan, 1993; Cecelski, 1990; Munasinghe and Munasinghe, 1988, Pearce and Webb, 1987; Fluitman, 1983; Schramm, 1993). These point to the disparities between expectations of the effects of rural electrification and the actual effects. RE has been justified on its presumed potential to stimulate rural growth and infrastructural development, which are themselves presumed to have positive effects at both economic and social levels. Cecelski (1990) has argued that RE is "not a 'basic need', but a high quality, expensive energy source that only becomes appropriate at high levels of income or productive potential", and that electrification is important to rural development as "one element of an effective integrated rural development strategy" (p.1). Her summation of the experiences of rural electrification points out that under the "right conditions", specific benefits accrue from rural electrification. We argue that one such benefit could be improved health in rural populations both as a direct result of electrification and as a result of electricity's potential to improve rural infrastructure (World Bank, 1994), with concomitant health implications. We argue further that health is contingent not solely on infrastructures but on human behaviours, and we suggest that where specific conditions are met - such as gender equity in household access to electricity and appliances - RE could play both direct and indirect roles in improving the health of rural populations.

The report that follows is an investigation into the potential role of RE in health promotion in South Africa. A number of health-related effects are touted by proponents of rural electrification (RE), and our paper concentrates on examining these firstly as they are represented in international literature, then as they are envisaged in South African health and energy planning, and finally as they are achievable in South Africa currently. We address some of the patterns of ill-health and injury that are recorded in rural areas of South Africa, with particular attention to the epidemiological and energy-use profiles of the Northern Province and KwaZulu-Natal. We also briefly discuss water and sanitation provision in these two provinces, in line with our argument that such services are crucial to health production at a household level. Our starting point is that health is primarily a household product, an outcome of a series of interactions and decisions that are taken at the household level (although constrained by factors beyond the household). Individual health is therefore contingent on social dynamics that shape and mediate household functioning, and that determine the infrastructures available to householders. Such variables include[1] age and gender relations; size of household and stage in developmental cycle; income levels and reliability; household decision-making processes; migration and mobility patterns as these affect household composition and durability over time; investments in health producing outcomes (such as energy sources, appliances, sanitation, water supply, housing, etc.). Such factors must be taken into consideration when predicting and evaluating the effects of RE. The paper concentrates on two levels of health provision; that is, the household production of health (see Berman et al., 1994), and the provision of services that have health effects[2]. Health services can also be divided into two levels; those services that facilitate good health directly (e.g. the provision of sanitation and water) and those services that are important in decreasing the individual experience of illness (e.g. hospitals, clinics, trained staff, medication). It is clear that the two levels are linked; provision of services such as sanitation and water supply have an effect on health at the household level and thus impact directly on the services that are likely to be required and offered at rural health centres such as clinics.

At the outset it is necessary to make four important comments. The first is that there are substantial, qualitative differences between patterns of illness, well-being and disease between rural and urban areas (Bourne, 1996; Peden and Abrahams, 1994). For the most part, biomedical literature that examines the impact of energy on health concentrates on material gathered from urban areas. There is thus a paucity of material pertaining to

1 The list is given as an indication and is not comprehensive.

2 Our discussion does not concentrate on what has come to be known as "environmental health" *per se* (see von Schirnding, 1992; WHO, 1992; van Horen, 1994). We treat environmental factors as health-related components of rural development.

epidemiological profiles in rural areas, and to a lesser extent, to the effects of various energy forms used in rural areas. This is especially true of South Africa (see Thom, 1994; Peden and Abrahams, 1994), where the health of rural populations has been integrally shaped by the disparities and inequities of the apartheid system. In this regard, it should be noted that the bulk of the rural populations that form the focus of the provincial study of this paper were formerly included in "homelands". For this reason we do not address farmworkers on commercial farms in detail (see Hofmeyr, 1994).

The second fact to bear in mind is that biomedical literature tends to focus on ill-health rather than on well-being (see reviews in HCO, 1995; van Horen, 1994). A substantial literature illustrates the ill-health producing functions of different energy sources[3]. A smaller literature examines the role that energy sources play in the production of good health at both a household and community level. In part, the limitations of the literature reflect the continued reliance on non-electric energy sources for domestic consumption even after the introduction of electricity. However, they are due also to uncritical assumptions of electricity's role in rural development and in the amelioration of rural living conditions. Some of the debates that surround this issue are briefly addressed below.

Thirdly, a number of excellent comparative reviews of RE projects have been conducted, all of which point to the specificity of local conditions in determining the effects of RE. By local we mean both conditions specific to a country and also those conditions that characterise a region. For example, South Africa's rural areas are marked by an extremely high rate of male migration to urban areas, and a growing population of female migrants. Any rural development programme must therefore take into account demographic features of populations, household composition, anticipated changes in migration, and also the preparedness of migrants to invest in the envisaged rural development. At a local level, cognisance must be taken of differences in, for example, epidemiological profiles across regions[4]. These diverse factors determine the kinds of effect that rural development and rural energy sources are likely to have on particular populations.

Finally, it should be borne in mind that ill-health and disease are not static phenomenon that exist independently of the activities of people they affect. Changes in context and behaviours will produce changes in peoples' health status and in the epidemiological profile of regions (Jamison and Mosley, 1991). For example, the provision of pumps and improved irrigation techniques may increase water-borne vectors, thus having a negative impact on health. On-going epidemiological surveillance and education on the health aspects of components of rural development is therefore important. In addition, current predictions are that there will be a major shift in world patterns of urbanisation - by the year 2000 forty percent of the world population is anticipated to be urban (Jamison and Mosley, 1991). This carries concomitant implications for changes in disease profiles (such as increasing injury)[5].

2 RE and health: claims and critiques

Literature on RE is marked in important respects by silences and absences, the greatest of which is a lack of reliable longitudinal studies that trace the effects of RE on health. Such studies as exist seem to fall into three main categories: (i) studies that assume positive health gains as a result of RE, but that provide little or no evidence or rigorous analysis; (ii) studies, usually post-electrification, that examine the implications of electrification for health at a general level - these studies tend to be "once-off" and are not longitudinal; (iii) studies that focus specifically on the energy requirements of service provision in formal health structures (such as hospitals). Our discussion draws on all of these, noting the limitations of current research approaches to health and RE.

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3 Electricity has not been subject to the same critical evaluation save for an emergent debate on the role of electro-magnetic fields [EMF] in cancer.

4 For example, water-related diseases are more characteristic of well-watered regions (such as KwaZulu-Natal) than the drier regions (such as the Northern Cape). Similarly, there are changes in seasonal disease patterns.

5 Note however that the model of migration is too simplistic to carry great predictive value in South Africa.

There are marked disparities in the health profiles of developed and lesser developed countries. In general descriptive terms, developed countries are characterised by chronic diseases of lifestyle such as cancers and diseases of the circulatory system. Lesser developed countries are characterised by infectious and contagious diseases, respiratory ailments and parasitic diseases. These are particularly marked in rural populations. In addition, rural and urban areas are characterised by different patterns of health and illness - a characteristic that is made more complex in South Africa as a result of the disparities of Apartheid. Seventy percent of Africa's population of 650 million people live in rural areas (Isoun, 1993). Infant Mortality Rates (IMR) and maternal death rates are very high, with the main causes of disease for children being diarrhoeal and respiratory. Energy-use and fuel types are implicated either directly or indirectly in such diseases. Biomass and charcoal account for more than 90 percent of energy demand and consumption in Africa's rural areas (Isoun,1993). Particulate matter and chemical pollutants released by combustion of these fuels have been found to impact directly on the respiratory status of children and adults. In addition, the lack of particular kinds of fuel and appliances (such as electrical pumps) that have indirect health benefits (improved household water supply and sanitation) limits the potential of rural populations to achieve health.

A number of claims that impact directly on health have been made for RE (see summaries in Davis, 1995; Ramani, 1992). We list them below, imputing possible health effects. Each claim has important implications for household and community relationships, including the division of labour, the shapes of gender relationships and the disparities between rich and poor households.

Among others, RE is anticipated to:

- Increase agricultural, commercial and industrial development, leading to an improved local economy and thereby decreasing the prevalence of poverty-related diseases.
- Reduce urban-rural migration. If this is so, then it could have a substantial effect in stemming the spread, or changing the pattern of spread of the HI virus and the development of AIDS in South Africa's rural areas.
- Reduce fertility rates (Sokari-George and Emereum, 1991; Barnes, 1988).
- Reduce domestic air pollution through the provision of safe cooking fuels. In this case, substantial health benefits are expected to accrue to women and children through the reduction of exposure to particulate matter and chemical emissions that have been proven harmful to (respiratory) health. Alongside diarrhoea, acute respiratory infection (ARI) is the greatest cause of infant mortality.
- Improve nutrition. Provision of adequate energy and appropriate appliances will allow storage of foodstuffs and will also reduce cooking times, ensuring greater retention of nutritional value.
- Enable the provision of safe water and sanitation through improved pumping mechanisms. Most infant death is as a result of diarrhoeal disease caused by inadequate access to safe water, inadequate water supplies, unhygienic sanitation and food preparation practices, and inadequate sanitation.
- Reduce injuries or mortality caused by the use of fires or paraffin to cook.
- Provide improved lighting. This is anticipated to have concomitant effects on education and literacy levels (Cecelski, 1992). Education and literacy are frequently seen as the first step in rural development projects. Maternal education is a strong indicator of child survival (Cleland and von Ginneken, 1988; Bicego and Boerma, 1993), possibly because it correlates with household income, general levels of education and child-rearing practices.
- Provide opportunities for the development of home businesses. It is generally anticipated that such businesses will increase disposable cash in households, leading to improved nutrition and general health.
- Promote health through educational television programmes.
- Improve the range and quality of services offered by rural clinics and other health services. Improved energy supply is anticipated to allow for the use of more effective

technologies: to offer longer opening hours, including a 24 hour service; to maintain the cold chain in vaccination programmes; to facilitate disease surveillance (health informatics); to offer educational opportunities to visitors and patients; and to attract staff (see Ward, 1993; Davis and Nghikembua, 1995).

- Provide a completely safe energy source for domestic and community living.

With few exceptions, however, there are counter-claims to each of the claims made above:

- The direction of causality between rural development and electrification is not clear (Cecelski, 1996; Davis, 1995).
- Some evidence suggests that rural-urban migration increases or that rural-rural migration patterns change, after electrification (Barnes, 1988; Carrasco Valencia, 1990). South African migration is however more complex than a simple linear explanation allows.
- There is no adequate study of the effects of RE on fertility rates. Studies quoted above tend to impute causality to electrification rather than show causal links.
- In South Africa, substantial evidence drawn from studies of electrification in both urban and rural areas suggests that people continue to use non-electric sources of energy for cooking even after electrification. In addition, household dynamics and divisions of labour create inequities at a household level in access to the health benefits offered by electrification (Ross, in HCO, 1995).
- Similarly, reduced injuries caused by fuel-related accidents in households requires that electricity is used as the main source of energy for cooking.
- Evidence drawn from urban areas of South Africa suggests that people living in newly-electrified households run a greater risk of atherogenic diseases as a result of increased intake of high carbohydrate and high fat foods (Bourne et al., 1993)
- Evidence for improved literacy and education is not conclusive. Some studies show that children spend more time studying, whilst others indicate that electrification leads to increased television viewing and less study (Cecelski, 1992; Carrasco Valencia, 1990).
- Where home businesses are introduced as a partial result of increased hours of evening light, it is likely that women and children's work will increase, with concomitant health-effects (reduced sleep hours, etc.) (Cecelski, 1996).
- Health will only be improved through television programmes where these are specifically designed for the populations at which they are aimed; screened at appropriate times and in appropriate languages. Devising television programmes is costly. In addition, television coverage in many rural areas is inadequate. There is also some evidence to suggest that there is a relationship between violence and television viewing (see summary in HCO, 1995; Bowie, 1997), although the direction and strength of causality is not yet clear.
- Adequate health services are less reliant on energy supplies than on the presence of well-trained staff, adequate infrastructure and water/sanitation supply and good communication networks, including road systems. Walker et al. (1994) argue that the presence of trained staff on 24 hour call in Gambia was largely responsible for decreased rates of IMF. They suggest greater training of community health workers and incorporation of traditional healers into South African health service systems. (The latter is already being undertaken in KwaZulu-Natal).
- Currently debate rages as to the health aspects of high voltage electric wires (as in grid connections). Evidence that these are involved in causing cancers is not conclusive as studies are marred by interference from multiple variables (see summary in HCO, 1995). However, it is advised that high voltage lines should not be run through communities.

There is also a substantial body of literature, both international and local, that indicates that the benefits of electrification are more likely to accrue to those who use it as their main

energy source than those who do not. This means that the poorer rural populations - who are already at higher risk of inadequate health - are also those people who are less likely to experience the health benefits of electrification.

While the counter-claims listed above are extremely persuasive, there are also counter-claims to them. Barnes (1988) has argued that those rural dwellers who have access to electricity - even when poor - are better off than their peers who do not have such access. Mbewe, Mariam, Ramasedi, Khalema and Ahmed, contributors to an edited book on RE (Ranganathan, 1992), all argue that claims against the efficacy of RE are driven by models of (economic) return that are biased to urban areas and that are not responsive to the social demands and practices of rural dwellers. It seems likely that the assessment of the impact and efficacy of rural electrification should be measured over a longer period of time than in urban areas.

From the brief discussion above, it is clear that energy plays a largely indirect role in health production (although, as we shall see below, some energy sources are directly implicated in *ill*-health). Where RE has a direct role - as in decreasing domestic air pollution, leading to reduced ARI - its impact is mediated by social variables (such as labour divisions, gender variables, decision making over appliance purchases, etc.). Notwithstanding current dissatisfaction with the effects of RE and debates over its efficacy, there are important long-term health benefits that could accrue from electrification of rural areas, where electrification forms part of a coherent and carefully designed rural development programme, and where (household) conversion to electricity is complete. The remainder of this section of the paper will examine these benefits from a health perspective.

2.1 The health effects of energy sources used in rural areas

Energy sources can impact both directly on human health (e.g. through the reduction of domestic air pollution as a result of decreased use of biomass fuels) and indirectly through their ability to provide services that ameliorate health.

Direct effects of energy on health.

As stated above, studies of rural health and energy use are limited, and under-reporting is rife, in part because of inadequate record keeping, partly because health services are frequently so difficult to access that many people do not seek medical attention, and partly because people seek health from a number of different institutions, including traditional healing resources. Much of the biomedical literature on the relation between health and fuels is drawn from studies in urban environments, and has been reviewed in HCO (1995). We summarise the findings of that report here, and where rural evidence is available or adds different dimensions, it is included in the discussion.

- *Respiratory illnesses*

Substantial evidence indicates that there is a causal link between respiratory illnesses and the particulate and chemical matters released during the combustion of biomass and coal. Particulate matter of less than 10 microns and chemicals such as sulphur dioxide are causative agents in ARI, particularly among children; allergies; pneumonia and asthma, bronchitis and chronic obstructive lung diseases. Air pollutants may also affect the gastro-intestinal tract and skin. Increasingly it is being recognised that mortality is functionally dependent on fine particulate matter - 2.5 microns and less (Ozkaynak, 1993; Ostro, 1993; Hoek and Brunnekreef, 1993).

Emissions from woodfuel combustion in rural areas have been found to be as deleterious, if not more so, than the air pollution levels in urban areas (Terblanche, 1993; see also studies of rural indoor air pollution by Norboo et al, 1991; Armstrong et al, 1991). According to Armstrong et al, respiratory infections are higher for young Gambian girls carried on their mothers' backs whilst the latter cook. The study does not say why girls are more at risk than boys, and points to the importance of studies that are sensitive to child-rearing practices and gender-related divisions of labour.

Many of the studies on air-pollution also highlight the negative health implications of smoking (Bartecchi et al, 1994).

- *Burns and fuel-related injuries*

South Africa's burn fatality rate is substantially higher than in the industrialised world, and is highest for black South Africans, who have least access to electricity. There is massive under-reporting of burns rates in rural areas, but it is likely that burns are as prevalent, if not more so, than in urban areas. Severity of burns is related to cooking practices (Ellegard and Egneus, 1993; Jie and Ren, 1992), including cooking on open fires and inadequate ventilation.

- *Poisoning*

South Africa has a very high rate of paraffin poisoning of young children. Whilst most people in South Africa's rural areas are reliant on woodfuel or coal, there is nevertheless a substantial proportion of the population that uses paraffin (Thom, 1994), which has concomitant implications for illness.

- *Electro-Magnetic Fields (EMF) and cancers*

International debate on the relationship between electro-magnetic fields and forms of cancer is growing. Studies are confounded by the fact that many high voltage lines run parallel with roads - motor emissions are implicated in some cancers. Nevertheless, it is recommended that as a precautionary measure, high voltage lines are not run through areas of habitation. This has particular import when RE through connection to the national grid is considered.

Indirect effects of energy on health.

Energy provision has a role in the production of health through the amelioration of services and in providing infrastructure that is implicated in improved health. Adequate energy sources are indicated in the provision of safe and sufficient water supplies, sanitation services, effective health procedures (such as the maintenance of the vaccine cold chain). In addition, infrastructural developments that are aimed at reducing energy inputs (such as improving the thermal capacity of housing) may have positive health effects in that they may reduce the need for additional expenditure of energies that are harmful to health. Below we briefly examine some of the indirect effects of energy on health.

- *Health services provision.*

The delivery of a number of health services requires a reliable energy source and supply. For example, a good 24 hour service or emergency service in a clinic is dependent on adequate lighting and communications (see Ward, 1993; Davis and Nghikembua, 1995; EDG, 1994). In addition, effective service is dependent on effective maintenance of appliances and health technologies (Bedford, 1996). Appropriate buildings and adequate staffing quarters and adequate security measures (including external lighting) are frequently cited as important mechanisms for attracting and retaining staff in rural areas (see Ward, 1993; HCO, 1995).

Specific health interventions necessitate reliable energy sources. The most common example is that of vaccinations, which are a key component of any Primary Health Care intervention. Vaccines should be stored at between 0^{o} and 8^{o} in order to ensure their efficacy. A number of studies have indicated the difficulties of keeping vaccines at the required temperatures (see HCO, 1995) because energy sources are inadequate or appliances are faulty. A recent South African study (Benade, 1994) shows that the vaccine 'cold chain' could be further compromised by a number of factors that include a lack of recording of temperatures of fridges, the storage of staff's personal foodstuffs in the fridge (necessitating frequent opening and closing of doors with concomitant losses of cold air) and inappropriate storage techniques. In other words, while a reliable energy source is a necessity in maintaining the integrity of vaccines, behaviours also may impact negatively on vaccine storage.

However, it is not only vaccines that require energy sources. Purified water is essential to effective health provision. Reliable energy sources are thus required to pump water and to enable purification (e.g. through boiling).

- *Primary Health Care (PHC)*

PHC interventions are described in the South African context below.

- *Sanitation and Safe Water*

The provision of water and adequate sanitation at a household level have been shown to be the most effective infrastructural intervention in the promotion of health (see summary of studies in Saunders, Groeneveld and Lerer, 1996). However, access to safe water and sanitation is limited in rural areas, and rural populations (particularly women and children) spend long periods of time collecting water. In addition, the distances may severely discriminate against the elderly and ill, who are unable to travel such distances. Reliable energy sources are required to pump water. It should be noted that improvements in irrigation techniques made possible by the installation of pumps, etc., may result in an increase of water-borne and vector-borne diseases (Yach, 1992).

A summary of studies presented by Emmett and Ragkoadi (1993) also indicates the limitations on consumption of water at a domestic level. Inadequate water quality and quantity are indicated in diseases such as cholera and typhoid, diarrhoeal diseases, and in health problems such as inadequate nutritional uptake rates. The World Health Organisation recommends a minimum per capita consumption of 20 to 50 litres per day. In surveys conducted in KwaZulu-Natal (summarised in Emmett and Ragkoadi, 1993:154), it was found that where natural water sources were used, average consumption was of the order of 10 litres per person per day. It should be noted that where water was vended, consumption rates rose dramatically, with the majority of households using between 50 and 100 litres per day. The authors comment that these trends are similar to those of other regions, with a complicating factor in that where populations are reliant on natural sources of water, consumption rates are dependent on climatic supply features, such as drought.

- *Housing*

Thermally effective housing may reduce the need for space heating, and thus for the use of harmful substances such as coal and wood. Improved household sanitation is essential in decreasing gastro-intestinal diseases, while provision of sufficient quantities of water in conjunction with sanitation has shown to have the highest rate of return in reducing diarrhoeal morbidity among infants (Saunders et al., 1996:5). Improved lighting impacts positively on quality of life, by providing more hours for relaxation. Some studies predict that improved lighting will stimulate the growth of small home businesses run by women. Depending on household and gender dynamics, this may improve the health status of households (e.g. by making more money available to purchase nutritionally sound foods, etc.). However, small business development may have a negative impact on women's health, resulting in longer hours of work and less sleep, less recreational time, etc.

- *Nutrition*

Fincham et al (1993:7) argue that adequate nutrition "requires access to food (household food security), protection from infection, including environmental sanitation and access to health care, and a society where parents have the opportunity to care for their children". Energy has a role to play in several of these factors. For instance, the type of food and available energy sources determine cooking, storage and eating practices - where fridges and stoves are available food can be stored longer and cooked faster, thus retaining nutritional value. Hygienic practices in food handling are partially a result of domestic water availability, for which an adequate and dependable energy source is required. Some PHC interventions are likely to be compromised or ineffective where appropriate energy sources and appliances are absent (e.g. vaccines).

- *Education and surveillance*

Education is essential to the promotion of health. Numerous studies have found that maternal education is a key component in the reduction of child mortality. It has been suggested that electrification plays a limited role in all education save that provided in adult literacy classes (James, 1993), and if women are able to attend such classes, then it is possible that there will be a positive effect on child health.

Epidemiological surveillance systems will be of great benefit in improving knowledge of disease patterns in rural areas. South Africa is currently developing a rural surveillance

system (RISS - Peden and Abrahams, 1994) for the recording of trauma. The system could be expanded to provide disease surveillance also, and would benefit greatly from electrical technologies such as computers in their mapping of patterns of trauma and disease.

- *Violence and injury*

In a comparative study on the burden of injury in developing countries, Zwi (1993) indicates that violence, both interpersonal and state, is a prime cause of injury morbidity and mortality in South Africa. A study undertaken in rural areas of the Western Cape (Peden and Abrahams, 1994) indicates that more than half of injuries reported to hospitals in these rural areas were caused by interpersonal violence, for which men between the ages of 20-29 were at greatest risk[6] (p. 2). Respondents in a number of South African studies have suggested that the provision of community lighting is effective in creating safer communities (see summary in HCO, 1995). In addition, it is likely that where social conditions are ameliorated, violence rates will decrease. To the extent that energy is able to contribute to such processes of improvement, it will be an important component in decreasing injuries related to inadequate living conditions. However, political solutions are more likely to be more effective in reducing violence in South Africa (particularly in KwaZulu-Natal) than are infrastructural developments, although clearly the two are linked.

A growing body of literature documents the burden that injury places on developing countries (Smith and Barss, 1991; Stansfield et al., 1993; Zwi, 1993). The extent of occupational injury in rural areas is not well-documented locally. In the study cited above, Peden and Abrahams (1994:2) found that occupational injury accounted for 3.3% of cases of trauma reported in the Western Cape's rural areas. It is likely that there will be substantial variation between regions based on agricultural practices and the extent of industrial development in each region. Electrification may increase the risk of electrocution and hot water scalds, but will reduce the extremely high rates of childhood fatalities caused by burns among users of paraffin and coal (Lerer and Knobel, 1993).

2.2 Summary

From the discussion above it is clear that health is contingent on a variety of factors. Whilst it is clear from South African studies (see EPRET series, 1994) that electrification does not necessarily result in electricity use at a household level, there are, nonetheless, clear health advantages to rural electrification when it is viewed as one component of rural infrastructural planning. Provision of water and sanitation - ideally to each house and minimally to a central location - has important effects in decreasing diarrhoeal diseases. Provision of thermally efficient housing may decrease the need for space heating and may thereby reduce respiratory illnesses and injuries caused by reliance on biomass and coal. A further reduction in such illness and trauma will result from complete conversion to electricity as a cooking fuel, although clearly the conversion is tempered by available biomass resources, reliability and cost of the electricity supply, people's willingness to invest in appliances, and household power dynamics (such as who has control over disposable incomes where these exist). Improved lighting offers greater security and leisure time, and electricity may offer the opportunity to generate small businesses, with the concomitant possibility that these may improve household health status. These should be tempered with the warning that it is likely that benefits will not be equitably distributed within or between households.

Thus far in the paper we have examined the potential effects of electrification on health at both the levels of household health production and health service provision. We have shown both that some energy sources and the absence of rural infrastructures (including electricity) pose health hazards. We have suggested that notwithstanding critiques, RE may play an important role in ameliorating health - although the effects will only be felt in the long term and in all probability will not be equitable at the household level. As we have seen above, it seems likely that electrification will have its greatest impact in preventative care at the level of the household, through the amelioration of air pollution levels and a reduction in burns and poisonings. It could also have significant indirect benefits where it enables the provision of safe water and sanitation at a household level.

6 Note that domestic violence against women is greatly underreported in South Africa.

Equitable and reliable energy provision should be considered an essential component in infrastructural development for health. As Saunders et al. (1996:14) point out, it is insufficient to provide inferior services to disadvantaged populations. They indicate that countries that have large gaps in quality of infrastructure between rich and poor have the worst overall health status, and point out that diseases related to poor infrastructure (TB, cholera, etc.) are frequently contagious. This idea receives particular salience in South Africa's health planning documents, which are the focus of later sections of the report. Whilst the thrust of the health care system is towards "preventative medicine", policy documents and discussions tend still to emphasise the role of biomedicine in disseminating health through provision of services such as clinics and hospitals. In discussions about health provision in rural areas, clinics seem to be prioritised rather than interventions at a household level. In other words, prevention is still seen to be within the biomedical domain, rather than occurring at the level of households. This fact is not unique to South Africa. The World Health Organisation recommends one clinic for every 10 000 people. In South Africa this translates into some four thousand clinics. Currently approximately 3 000 clinics exist, of which 1 000 are in need of major repair or upgrading. In order to explore the provision of biomedical services, the focus of this paper now shifts from the indirect benefits of electrification through the amelioration of household health to a concentrated focus on the South African context, particularly the clinics-building programme and its articulation with the vision of health articulated in recent health documents. In the discussion that follows we examine the health status of South Africans, showing the disparities in health that have resulted from inequitable planning and service provision in the past. We then discuss the "ideal" health system as it is described in current health documents. From there we move into a discussion of clinic-building programme. Finally, we move to an examination of the potential health effects of electrification in South Africa, with a critical discussion of the importance of energy as one of a number of needs and services to bring about health.

3 Health status of the South African population

PROVINCE	*POPULATION*	*%URBAN*	*%RURAL*	*%MALE*	*%FEMALE*
Northern Cape	776 743	73.1	26.9	51	49
Free State	2 903 304	54.4	45.1	53	47
Mpumalanga	3 344 170	31.9	68.1	52	48
North West	3 646 361	28.2	71.8	49	51
Western Cape	3 771 867	86.5	13.5	51	49
Northern Province	4 823 554	8.9	90.1	46	54
Eastern Cape	7 057 409	34.8	65.2	45	55
Gauteng	7 915 017	96.0	4.0	53	47
KwaZulu Natal	8 881 491	37.6	62.4	48	52

Table 1: Population of South Africa, disaggregated by province, residence and sex.

(Source: DBSA, 1996:45 and South African Health Review (SAHR), 1996:6-7.)

Since the installation of the Government of National Unity in 1994, operating with a general policy framework of the Reconstruction and Development Programme (RDP) devised by the ANC, policies and programmes with positive implications for the health status of the country have been put into place[7]. Primary Health Care (PHC), a vision of health that prioritises preventative and health interventions at a local and district level, is the core around which the new health care policies have been developed. The major vehicles envisaged for PHC in rural areas are clinics. Table 1 disaggregates South Africa's population by province, urban or rural residence and sex in order to show the relative size of the populations with which this paper deals, and for which rural clinics are seen as an important intervention.

7 Note that at the time of writing the Health Act had not yet been passed through Parliament. Our discussion is based on the African National Congress (ANC) health documents, the RDP, and the Health Bill.

3.1 Health status of South African population.

South Africa is characterised by substantial disparities in access to quality health care and infrastructures - the product of apartheid planning and poverty. In general it can be said that whites in South Africa enjoy better health and have greater access to better health care services than blacks. As a result there are differences in the disease profiles of sectors of the population. Whites tend to suffer more from chronic diseases of lifestyle, while black morbidity and mortality rates reflect patterns indicative of diseases of poverty (e.g. contagious and infectious diseases). In addition, there is disparity in health services in rural and urban areas, and epidemiological profiles of rural areas differ substantially to their urban counterparts. Table 2 illustrates some of the main indicators of child and adult morbidity and mortality in South Africa.

	Whites	*Coloured*	*Indian*	*African*	*average/total*
Mortality					
IMR*, 1994	7.3	36.3	9.9	54.3	48.9
MMR**, 1992	8	22	5	58	-
% death - respiratory, per 100 000, 1990	7	15.7	7.4	12	-
Morbidity					
TB/100 000, 1993	18.8	712.5	50.8	206.6	224.9
malaria/100 000, 1993	15.3	0.3	0.9	32.8	27.5
% HIV+, antenatal, 1994	0.4	1.3	7	7.3	7.6
Risk taking behaviour					
% adults smoke, 1995	35	59	36	31	34
Nutritional status, children					
% stunting(<6yrs),1994	4.9	19.1	6.1	28.3	-

Table 2: Health status and disease profiles of South African population.

(Source: Adapted from SAHR , 1996:229).

** IMR = infant mortality rate ** MMR = maternal mortality rate*

3.2 Household infrastructures in rural areas

Households in rural areas lack access to basic infrastructures. This means that ill-health is exacerbated by living conditions that do not ameliorate health. Table 3 describes the prevalence of household water, sanitation and electricity in each of the provinces of South Africa. Note that these data are not disaggregated into urban and rural areas.

3.3 Access to health care.

The findings of a household survey conducted by CASE in 1995 underscore the disparities discussed above. Poverty, combined with poor public health conditions - overcrowded housing, lack of accessible drinking water and sanitation - make Africans most vulnerable to ill health. Yet those who are at greatest risk also have the greatest difficulty accessing health services. It is the population living in rural areas which must travel furthest to reach a health facility, which must wait the longest to see a health provider and for whom a medical consultation is most likely to last less than five minutes. The study found that 73.8% of African people reported the cost of health services to be the major barrier to care and 11.5% the unavailability or high cost of transport. 50.9% of African people rely on taxi or public transport (55.5% in rural areas), while 37.4% reported that they must walk to their site of care. Approximately one third of Africans in rural areas (24.1% of reported cases) are more than one hour travelling time from the closest health care facility. Distance from a health care facility is greatest in the Northern Province, Eastern Cape and KwaZulu Natal. 70.3% of Africans (73.8% in rural areas) reported waiting one hour or more to see a health provider. 48.2% waited more than two hours and 17.7% waited four to five hours. Half of African respondents reported that their consultation with a health provider customarily lasts five minutes or less. From the above, it is clear that limited access to health care services and professionals in rural areas is a major contributor to mortality and morbidity rates - especially for childbearing women and children.

	E. Cape	*M'langa*	*Gauteng*	*KZN*	*N. Cape*	*N. Prov*	*N.W.*	*F. State*	*W. Cape*	*SA Tot/Ave*
% Households with tapwater in dwelling (1994)										
White	97.5	96.6	98.6	99.1	98.9	91.4	99.7	97.4	99.4	98.4
Coloured			93.7		29.2				85.5	76.0
Indians			99.5							97.7
Africans	16.3	20.1	57.2	25.9	20.2	12.9	21.1	19.1	39.5	27.4
% Households using electricity as main energy source (1994)										
Whites	95.8	99.1	98.4	99.4	81.9	97.9	99.7	99.8	99.4	98.2
Coloureds	53.7		93.5		37.1				83.9	75.7
Indians			99.8							98.5
Africans	12.0	20.0	64.6	31.7	29.9	14.0	25.1	31.7	46.5	30.5
% Households without sanitation facilities (1994)										
Whites	0.1			0.0			0.0	0.0		0.0
Coloureds	5.8		0.1							2.4
Indians										0.1
Africans	28.8	16.8	2.6	8.9			13.0	12.7		12.6

Table 3: Household infrastructures by province

(Source: Socio Economic Indicators: CSS October Household Survey 1994, in SAHR, 1996:222)

4 The Restructured South African Health System

In order to begin to address the disparities in health and access to health services, the South African health system is undergoing restructuring in line with a model that devolves responsibility for health care to district health systems. The restructuring occurs in line with propositions contained within the Bill of Rights and the models of district health care that decentralise health provision from national to the provincial and local levels.

4.1 The Bill of Rights of the Constitution

Section 27 of the new Constitution deals with health care, food, water and social security, access to each of which is recognised as a fundamental human right. The section reads:

a) Everyone has the right to have access to -
   - health care services, including reproductive health care;
   - sufficient food and water; and ...

b) No one may be refused emergency medical treatment.

The onus for provision of such rights rests on the state. Beyond those rights directly aimed at improving health, a series of related rights should provide an enabling framework for improving the health of the population. For example, the comprehensive rights of children, including the rights to basic nutrition, shelter, basic health care services as well as rights to adequate housing, basic education, the right to life and the right to have their human dignity respected and protected should also promote conditions in South Africa that are conducive to child and adult development.

In order to redress the inequalities of the past especially in the rural areas and deprived communities, the government has embarked on a campaign to restructure the health system using the Primary Health Care approach (see below).

4.2 Primary Health Care

PHC is considered to be the most suitable way to achieve the global goal of "Health-for-All". PHC is only possible through an integrated mix of curative, preventive and health promotion activities organised in active collaboration with local communities. Health problems have many and complex causes whose solutions demand an intersectoral approach. Other sectors such as those providing clean water, sanitation, housing, etc. have a greater impact on health, than health services alone (see earlier discussion).

There has been criticism of the PHC model envisaged in the RDP (Price and van den Heever, 1994). The health priorities defined by the Ministry of Health reflect a reduced programme than that initially imagined in the ANC's national health plan (1994). In addition, the PHC interventions envisaged by the Health Bill tend to assume that interventions will take place at the level of clinics, rather than at the level of households. Thus whilst the emphasis is on preventative care, the interventions tend to be at a curative level. We take up this discussion later in the paper.

The task of implementing the PHC concept is too complex to be managed centrally and decentralisation of the health sector into health districts is envisaged. These are responsible for PHC, which, in rural areas, tends to take the form of clinic-provision. The Ministry of Health is envisaged as playing an advocacy role to ensure adequate attention to water provision, sanitation, roads, communication systems, stock health, housing, schools, and shops, as well as health facilities[8]. It is envisaged that there will be a redistribution of

8 There are substantial disparities in the allocation of health care resources within provinces. As at April 1996, a total of R190 million had been allocated by the Ministry to clinic development (SAHR, 1996:78). Much of the existing stock of facilities is in dilapidated state with crumbling electrical, water and steam systems, partly because facilities have not been upgraded or replaced as they reach the end of their natural lifespan, and partly because maintenance has been minimal, resulting in accelerated decay (*ibid.*). It is estimated that 27% of the total capital stock will need to be replaced or upgraded over the next ten years (*ibid.*:68).

human resources to rural areas, and that all categories of health personnel will have experience of working in rural settings (van Rensburg, Fourie and Pretorius, 1992). (Note that the suggestion that rural training and community work be a compulsory part of medical training has recently caused a considerable furore, and the suggestion awaits resolution.). Many of the government's priority projects will be implemented through PHC programmes. These are described below.

4.3 Priorities of the Ministry of Health

The Ministry of Health has drawn up three sets of priorities for health interventions. These address general priorities in health care; priorities for special groups, and other priorities. These are listed in Table 4:

PRINCIPLE PRIORITIES	*SPECIAL PROGRAMMES FOR VULNERABLE GROUPS*	*OTHER HEALTH PRIORITIES*
Nutrition	Women's health	Health Promotion
Maternal and child health	Occupational health	Drugs
Free health care policies	Rural health	Emergency Care
HIV and AIDS	Mental health	Substance Abuse
Violence	Chronic illness	Oral Health
Control of communicable diseases	Rehabilitation	Environmental Health
	The elderly	

Table 4: Ministry of Health Priorities.

In our discussion below, we concentrate on the principle priorities, recognising overlaps with these and other programmes, especially programmes to promote rural, women's and environmental health. It should be noted that the priorities set by the Ministry of Health are not the same as those laid out in the RDP documents, although there are a number of overlaps. Most significant for our purposes is the absence of programmes that are directly aimed at a lowering of ARI rates in children. While lowering of ARI can be construed as an intervention through environmental and rural health programmes and nutritional interventions (see below), it is nevertheless a matter of concern that ARI interventions through changed energy-use patterns has not been made an immediate priority.

Nutrition

Two main nutrition-related interventions have been identified by the Ministry of Health as important to supplement nutritional deficiencies. These are fortification and breastfeeding. In 1995 a meta-analysis of South African dietary surveys (SAHR, 1996:150) found that rural African children aged 2 - 6 and 6 - 11 years experienced the lowest energy intakes, while the highest energy intakes were in rural African women. The study also found that Vitamin A intakes[9] were low in African children and in African and Indian men, and that African women in rural areas had low folate intakes. A recent study of ARI and Vitamin A found poor housing and lack of electricity to be significant risk factors in childhood ARI (Dudley et al., 1997). In other words, poor infrastructures jeopardise the health of those already at risk of disease because of poor nutrition.

Studies in urban areas (Bourne et al., 1993) have also indicated dietary changes that are implicated in atherogenic diseases (such as heart disease). Changes in dietary pattern are linked with disposable income and altering cooking practices wrought in part by electrification. Bourne argues that "Those who can afford the higher-order fuels aspire to a fattier, more refined ... [diet]" (in HCO, 1994:66). This evidence and high rates of ARI are indication that energy plays an important role in health - a role that the state has not identified as a priority health intervention.

Maternal, Child and Women's Health

- Malnutrition and infection, especially diarrhoeal disease and ARI are the most important causes of morbidity and mortality in infants and young children. Yet, only

9 Deficiencies of Vitamin A, iron and iodine contribute to significant morbidity, mortality, growth retardation and diminished cognitive development and work capacity in adults and children.

60% of respondents in the CASE (1995:22) household survey were aware of oral rehydration solution, a solution of sugar and salt in cooled boiled water, to combat the dehydrating effects of gastric ailments in children. Adequate supplies of safe water and of energy with which to sterilise it through boiling are thus essential components of Oral Rehydration Therapy (ORT), as is adequate dissemination of information about preparing and administering ORT.

- The most optimistic estimate of vaccination coverage shows high coverage - 95% for BCG (Vaccine against tuberculosis) gradually decreasing to 85.5% for measles. However, in rural areas children had significantly lower vaccination coverage than their urban counterparts. Table 5 illustrates the complete immunisation (TB; measles; polio; diphtheria, whooping cough and tetanus) levels of African children in rural and urban areas. A new vaccine against the rotavirus that causes childhood diarrhoea is soon to be tested in South Africa (Medicine Today, 1996:11). Diarrhoea is estimated to cause 28 percent of childhood mortality in South Africa. The possibility of a preventative vaccine indicates once again the importance of the immunisation process and thence of maintaining the integrity of the cold chain.

complete immunisation	*urban formal*	*urban informal*	*rural farms*	*rural homelands*
yes	25.6	22.6	21.7	214
no	43.7	55.9	55	53.6
don't know	30.8	21.4	23.2	25.4

Table 5: Percentages of complete urban and rural immunisation coverage for African children

(Source: CASE, 1995:21).

- Causes of maternal morbidity and mortality are antepartum and intrapartum bleeding, infections, ruptured uterus, abortions and pregnancy-induced hypertension. Most of the women who succumb to these pregnancy related emergencies, die because they can not access a health facility in time, or at all. Lack of access and consequent maternal deaths are particularly high in rural areas.

Free health care policies

Children under 6 and pregnant women not covered by Medical Aid are granted free health care at specified health services at all levels of the district health system. Free primary health care is envisaged.

HIV and AIDS

The Ministry of Health has emphasised the importance of education in the prevention of HIV and AIDS. There are concerns that rural health services will be stretched beyond their capacities as the epidemic takes hold.

Violence

Legislation to restrict ownership of guns is envisaged. Crisis centres may be established to assist victims under the umbrella of Safe Communities Initiatives

Control of communicable diseases

TB and HIV are priorities for intervention. Intervention is envisaged as improved access to PHC. However, it should be noted that adequate infrastructures are important in reducing communicable diseases.

4.4 Summary

The notion of PHC that has been enacted in the health documents reviewed has narrowed considerably in its scope from that which was presented in the ANC health plan. The notions of PHC as having an integral link to household infrastructural development seems to have been replaced in part with a focus on immediate interventions. One consequence of this has been the decreased emphasis on diseases such as ARI and their prevention through infrastructural development.

	E. Cape	*M'langa*	*Gauteng*	*KZN*	*N. Cape*	*N.Prov*	*N. W.*	*F. State*	*W. Cape*	*SA Tot/ Ave*
Total No of clinics, clinic satellites and health centres	645			407	134	333	300	281		
% of clinics and health centres with basic amenities (1994)										
Adequate water supply	54			80	93	70	70	93		
Grid Electricity	48			89	88	77	58	91		
Waterborne sewerage	45			59	43	51	42	73		
Telephone	62			85	87	77	57	90		
Obstetric and child care										
% of clinics with comprehensive MCH* services	41.4			12.8	79.2	70.0	57.0	41.0		
Immunisation (% up to date)										
% of PHC facilities with refrigerators	83.4			80.6	72.3	79.0	42.0	61.0		
Documented immunisation	50.5	64.3	71.4	53.9	69.6	73.1	74.9	62.8	69.7	63.0

Table 6: Health services provision in each province.

(Source: South African Health Review 1996)

** - MCH: Maternal and Child Care*

5 The Clinic Building Process

In this section, the focus of the paper shifts from the ideals described in working papers on health to a more concentrated focus on the South African clinic-building programme and its articulation with the vision of health promulgated in health documents. We have taken as two case studies the processes in KwaZulu-Natal and the Northern Province. The discussion therefore begins firstly with a focus on the clinic-building process, then focuses on the demographic and health profiles of the two regions and on the ways in which decisions are made as to clinic-building in each province.

5.1 Clinics and PHC

Clinics are a crucial component in PHC, particularly in rural areas in South Africa. The upgrading of clinics and the construction of new ones has been the focus of several programmes in recent years. Both the Independent Development Trust and the Central Economic Advisory services were involved in clinic building programmes in the early 1990's.

It is estimated that there is a need for approximately four thousand clinics. Bester comments that there are currently three thousand clinics in South Africa, of which one thousand are in need of major repair or replacement[10]. Clinic upgrading was one of the 22 Presidential Lead projects initiated in South Africa through the RDP after 1994, indicating the priority given to remodelling the health services by the new government. "Between May 1994 and August 1996 a total of 60 new clinics have been built and 47 existing clinics upgraded. A projected total of 301 new clinics will have been built and 100 upgraded by the end of 1997." (*ibid.*)

5.2 Policy-making and implementation

At a national level, the Department of Health is responsible for policy planning, and, until the current financial year, for budgetary allocations. In the past, the health budget has been allocated to the National Department, which then has allocated funds in consultation with provincial Departments on a per capita basis. The intention behind such a division has been to iron out past disparities. With effect from the 1997/8 financial year, however, health budgets have been seconded to the provincial level of government. Each department within the provincial government has then to bid for funds. Thus, departments of health in each province are now competing for funds at a provincial level with other government departments in the provinces. Whilst this does mean that the allocation of money at a provincial level may reflect the specific needs and resources of each province, the new allocation has immense political implications when viewed across provinces. It may now be that there is no guarantee that health plans envisaged at a national level will necessarily be given adequate funding at a provincial level to implement the national vision.

Whilst the policy papers on health seem to identify a standard set of health interventions and priorities, the process of implementing such priorities is not standardised. From discussions with various of the stake-holders, it seems that there is considerable variation between provinces and even regions on how decisions pertaining to the building, stocking and maintenance of rural clinics are made. In part this is a result of past disparities in health care resources, which saw three different systems in place to provide health services in the former South Africa, homelands and self-governing territories. Decisions as to the location of clinics are currently made at a provincial and regional level. There does not appear to be a standardised way in which such decisions are taken, as will become clear from our discussion of the Northern Province and KwaZulu-Natal below.

In implementing the Clinic Upgrading and Building Project (CUBP), the National Department of Health instituted a Health Facilities Planning Directorate which saw to the allocation of funding. Provinces applied for funds which were paid out according to priorities set in each province. Priorities have been set differently in each province. A standard set of modular options was made available by the Planning Directorate, and

10 Bester was a member of the Health Planning Directorate of the Ministry of Health. Personal communication, April 1997.

provinces could shape the modules to meet their requirements. The modules allow for the creation of two, four or six consulting room clinics, depending on population size (sizes are incremental in factors of five thousand people). In addition, depending on the number of births anticipated in a district, communities can also negotiate for a maternity module to be added to the clinic. Again, maternity modules come in one of three sizes. The net effect is that communities can shape clinics to their particular needs by selecting appropriate modules. Not all of the provinces have decided to make use of the modular option, with the effect that there is no standard process of clinic-building across provinces.

5.3 Other services supplied to clinics

Electrification:

It currently seems that the IDT and ESKOM set the pace for clinic-building and the electrification programme. The Department of Health does not appear to have developed a formal vision for electrified clinics. It is claimed that the Department of Health is not responsible for decisions concerning priorities at a national level[11], and the IDT has commented that the Department tends not to take responsibility for the clinics built. The Department of Health provides information to organisations such as the IDT and ESKOM should they request it, and the IDT has been invited to workshops held by the Planning Directorate of the Department of Health. Decisions pertaining to the building of clinics thus appear to be driven by the IDT in consultation with priority lists drawn up at provincial level by the Department of Health, and through formal liaison with Eskom every two months to determine whether the clinic falls within the range of the grid for electrification purposes. One Department of Health (KwaZulu-Natal) official commented that the regional department of health is responsible for prioritising the areas where clinics are to be built, while the IDT is responsible for completion of clinics and liaison regarding electrification.

Thus, clinic-electrification tends to take place in interaction between the IDT and Eskom, using regional clinic-building priority lists provided by the Departments of Health in each province. It seems that a national level there is little formal interaction between the National Department of Health, the IDT and Eskom, notwithstanding current rhetoric of partnerships. Both the IDT and ESKOM claim to have relationships with the Department of Health, but these are not clearly developed or articulated. Relationships between the Department of Health and Telkom and the Department of Water Affairs have also not been formalised at a national level. It seems that for the most part, interaction between all role-players exists at the provincial and local level, and appears to be largely dependent on the relationships between individual project managers and various institutions rather than on formalised sets of institutional relationships. Provincial service provision is not standard, and in different provinces administrative decisions are made at differing levels. For example, it seems that decisions pertaining to clinic-building and electrification in KwaZulu-Natal are made at a regional level with liaison to both provincial and district levels, whilst in the Northern Province they are made at the level of provincial government with regional liaison (see below).

It appears from impressionistic data that national electrification plans are implemented differently in the provinces, and that frequently there is little knowledge of electrification processes or plans at a provincial or district level, and still less liaison between key players in the clinic-building and maintaining processes.

Water:

Water-provision to clinics has been an important part of the clinic-building programme. The Department of Water Affairs is launching a massive drive towards supplying water in rural areas. The department is following an integrated approach, involving all stakeholders in the development arena to allocate funding from the World Health Organisation to the Department of Water Affairs for rural communities. The supply of services to clinics is seen by the Department of Water Affairs as the responsibility of the Department of Health.

The supply of water is more difficult and slow to implement than electricity because of the infrastructure required. The white paper on water and sanitation follows a long-term

11 Bester, personal communication, April 1997.

approach and focuses on building capacity within the community and at institutional level. All major stakeholders are included, including the Departments of Water, Health, Land Affairs, non-governmental organisations (NGO's) and regional government. Problems include sustainability and slow delivery, particularly at ward/village level, where local government functions are not always adequately devolved. For this reason district councils are consulted, with trust funds ensuring community involvement and empowerment.

There has also been competition between clinics and communities for limited reserves of water. In isolated areas the provision of water is discrete, not continuous and over-utilisation of bore-holes can lead temporary droughts. One effect of this has been that people tap water from the clinic supply, with the effect that water security has become a problem in certain places. An important health implication of lack of water in rural communities is that people present at clinics as patients with diseases caused by insufficient water. They are treated and then return again to the clinics with the same complaint. A more sustainable approach and greater spending on the provision of a continuous supply of water to communities will possibly remove conflict between rural communities and the clinics that have been established to serve them. Future research should focus on the relationships between energy and water provision at both household and clinic level.

5.4 Northern Province and KwaZulu-Natal.

Our discussion now contextualises the commentary above by examining the health needs and clinic-building processes in the Northern Province and KwaZulu-Natal.

This section examines demographic and health care features, water supply and sanitation provisions in the two provinces.

Northern Province

5.1 million people live in this province, of whom 92% live in rural areas. Almost half (48%) of the population is under 15 years of age, and only 3.7% are 65 years or older (Dept. Health, 1996a). The population density is 41.5 people per square km, and there are 568 health facilities including Hospitals, private clinics and only one private hospital. Local authorities administer 15 clinics, 7 satellites and 1 mobile clinic, and infrastructure at all clinics and health centres is grossly inadequate (*ibid.*).

Prior to 1994, the homelands governments and the IDT were responsible for building clinics in the Northern Province. It now seems that a number of these clinics (173) are not in use because buildings cost more than the budgets allocated, with the effect that many have not been properly equipped or maintained[12]. Thus, while clinic buildings that exist have been built with considerable community input, and match up to community aspirations, they appear to be neither efficient nor cost-effective, and do not match the actual requirements "on the ground". With the implementation of the CUBP project, the Northern Province decided not to build more clinics until those in existence were completed and operational. The province rejected the modular design of clinic-building in favour of their own designs which drew on emergent contractors. Difficulties were experienced by the contractors in getting guarantors for their work, which has delayed the clinic-building process subsequent to 1994.

Table 7 indicates the distribution of clinics with basic amenities in the Northern Province. In Table 8 we have shown the number of primary-level health facilities that have refrigerators in the Northern Province. The table thus illustrates the opportunities that are missed for child immunisation (assuming all other conditions are met) because facilities to maintain the cold chain are lacking.

12 Bester, personal communication, April 1997.

	% of clinics
grid electricity[13]	77
alternative electricity source[13]	27
two way radio communication	73
security fencing	65
pit latrine	65
septic tank and french drain	56
vacuum tank	18
water borne sewerage	51
telephone	77
adequate waste removal	56
adequate water supply	70
running hot water	42

Table 7: Clinics with basic amenities

(Source: adapted from Dept. Health, 1996a:23).

	% of facilities
clinic	84
clinic satellite	30
community health centre	60

Table 8: Primary level facilities with refrigerators

(Source: Adapted from Dept Health, 1996a:67)

Nine percent of the rural population of the Northern Province is recorded as having an indoor source of piped water, and seven percent as having piped water in a yard. Fifty-four percent were reliant on public taps, and twelve percent on boreholes or wells with pumps. One percent used wells that had no pumps. Seventeen percent of the rural population relied on natural sources of water, while less than one-half percent purchased water. The bulk of the population (76 percent) were reliant on pit latrines, while twenty percent had no toilet facilities. Four percent had waterborne sanitation systems, and less than one-half percent used a bucket system. Seventy-four percent of toilet facilities were indoors or in-yard (Emmett and Ragkoadi, 1993:154ff).

The Northern Province is allocated a large section of Eskom's rural electrification budget, as it has previously been a neglected region. However, as discussed above, there appears to be limited collaboration between stakeholders at provincial, regional and district levels.

KwaZulu-Natal

Sixty-two percent of the 8.5 million people who live in KwaZulu-Natal reside in rural areas. Thirty-nine percent of the population is aged fourteen and below. Only four percent of the population is aged 65 and above. The average population density is 93 people per square kilometre, ranging from 40 to 1063 people per square kilometre. 777 health services facilities exist. This figure includes Hospitals, private clinics and private doctors and thus differs from the primary health care facilities quoted on page 20.

In KwaZulu-Natal, clinics have been prioritised as a health intervention in rural areas. Most clinics have been built on the modular design offered by the Planning Directorate of the Department of Health, using extensive collaboration between nursing staff and communities to determine priorities which were then established and consolidated through interaction with regional managers and nursing staff, and with co-operation from the Department of Public Works and the Tender Board. Communities are responsible for the

[13] - these figures appear to be inaccurate as they contradict one another.

establishment of a community committee that oversees provision of unskilled labour in the building phase. Cleaners and security staff are drawn from the community. A process known as "fast-tracking", which by-passes lengthy community consultations, has been implemented in much of the clinic-building process in the province. Specific responsibilities are given to the community in this process, while the Department of Health undertakes to liaise with organisations concerned with clinic-building. The process has been criticised by the IDT, and it seems that there is still tension around its efficacy at a national level.

Table 9 documents the percentage of clinics that have basic amenities. Table 10 describes the number of health facilities without proper fridges (and by inference, it describes the limitations on opportunities for effective vaccination programmes assuming that all other conditions are met)

	% of clinics
grid electricity	89
two way radio communication	40
security fencing	65
pit latrine	14
septic tank and french drain	29
vacuum tank	13
water borne sewerage	59
telephone	85
adequate waste removal	77
adequate water supply	80
running hot water	60

Table 9: Clinics with basic amenities.

(Source: Health Department, 1996b:25)

	% of facilities
clinic	82
clinic satellite	21
community health centre	100

Table 10: Primary level facilities with refrigerators

(Source: Adapted from Dept Health, 1996b:67)

KwaZulu-Natal is largely reliant on natural sources for water. Four percent of the rural population had piped water in residences, one percent had piped water in the yard, nineteen percent were reliant on public taps, and nine percent on bore-holes or wells with pumps. One percent utilised wells without pumps. The bulk of water (62%) was drawn from natural sources (springs, rivers and streams) or dams, and the remaining five percent purchased water or used rainwater. Five percent of the rural population has access to waterborne sewerage systems, and five percent to bucket sanitation. Fifty-seven percent are reliant on pit latrines, and thirty-seven percent have no toilet facilities. Indoor or in-yard toilet facilities are available to only 42 percent of the rural population (Emmett and Ragkoadi, 1993:154ff).

KwaZulu-Natal has recently developed a strategy to integrate development initiatives. Although funding for other development is not always provided, the IDT are responsible for the provision of electricity. However, the Department of Health and the IDT are not in agreement as to the rate of electrification of rural clinics. In inaccessible areas the Department of Health have tried solar electricity as an alternative energy source, but upkeep and maintenance have been costly.

5.6 Summary

Thus far we have seen that the clinic-building and electrification process in South Africa has not been driven by a unique vision of the Department of Health but by the practices and history of institutions such as the IDT and Eskom. The Department of Health has not necessarily or even frequently been the most important role-player in all of these processes.

6 Energy requirements of the Health Services

The discussion now turns to contextualise the decision-making processes of clinic-building and electrification in the energy requirements of selected health interventions. We do this in order to get a sense of the importance of electrification in the practices of clinicians. We thus examine energy-related inputs to health, and try to explore their priority in the context of practices of providing services. We do this by using a case study of vaccinations, locating energy and the cold-chain in the context of the vaccination process as a whole.

6.1 Literature on health services and their energy requirements

Southern African studies of the energy requirements and energy efficiencies of rural clinics (see Ward, 1993; Benade, 1994; HCO, 1995; Bedford, 1996), indicate that energy sources other than grid electricity used to power equipment is frequently unreliable. This is of particular import for the integrity of the vaccine cold chain. Bedford shows that in the former Transkei, efficacy of gas fridges is dependent on a regular supply of gas from the parent hospital (1996:26), and that none of the solar systems in the clinics she assessed were effective. The assessment carried out by the HCO (1995) indicated that gas and solar-powered fridges frequently did not function correctly or lacked thermometers so that staff could check temperatures. Benade (1994) however, indicates that non-compliance with regulations for vaccine storage (such as inadequate appliance maintenance, infrequent temperature testing, storage of staff goods in fridges, etc.) is more likely to compromise the cold chain than failures in the energy supply itself. From the above it is clear that the vaccine cold chain is compromised not only by the lack of a reliable source of energy, but also by faulty or inadequate appliances, and by the activities and requirements of staff.

Research undertaken by Ward (1993) has shown that an important mechanism for attracting and retaining health care workers (including doctors and nurses) to rural areas is the provision of electricity and telephones. She also points out that staff felt that outside lighting was important in enhancing their security. Lighting is also important in that it may facilitate lengthening of the opening hours of health services. The Energy and Development Group assessment (1994) of Northern Botswana's power supply indicates that electric lighting has been of great benefit to the hospital which is able to offer a 24 hour service. The HCO study of nine clinics (1995) showed that four lacked any lighting source, and solar-powered lighting appliances in three clinics were badly maintained. Two clinics using electricity as their lighting source reported no problems with the supply.

The report focuses now on the potential energy-related impacts on health. Using a case study of the vaccine cold chain, we rank electrification in the contexts of the environment within which interventions are carried out, and the practices of intervention.

6.2 Energy inputs to health

Table 11 is an assessment of the energy inputs that are required to reduce some of the most common diseases outlined in the government's PHC and in other health documents. The energy directness scales (marked ED on the table), signified by "1", "+", and "?" indicate the directness of the relationship between an energy provision and a desired outcome. Thus, "1" indicates that the introduction of a particular energy intervention has a direct health outcome. "+" indicates that there are two or more steps, while "?" indicates that there is uncertainty over the relationship in the literature. For example, the provision of adequate energy sources will ensure that vaccines are kept at an appropriate temperature and will therefore impact directly on health ("1")[14]. Or, to give another example, the

14 As can be seen in this case, the ranking marks only the energy requirement - obviously for a vaccination to work properly it must be correctly administered to a child of the appropriate age by a competent member of staff in reasonably sterile conditions, and so on.

provision of electricity may lead to the development of business and jobs in rural areas thus reducing the need to migrate and thence having an impact on the spread of sexually transmitted diseases (STDs). The energy rating in this case would be a "?". In this case energy does not play either a direct or proven role in generating the desired health outcome.

Illness	*Prevention*	*Cure*	*Energy input*	*ED**	*E. source*
Fuel related:					
1 ARI	reduced wood/coal burning.	health services	electricity	1	elect/gas
2 paraffin poisong.	reduced paraffin use, lids, education.	health services	electricity	1	elect/gas
3 injury	maintenance, improved standards.	health services	electricity		-
Hygiene-related:					
1 diarrhoea	vaccine? nutrition, hygiene.	ORT - purified (boiled) water.	heating	1	any
2 scabies/skin diseases	hygiene, sanitation.	medication.	-	1+	any
Water related:					
1 diarrhoea	(1&2) household water supply,	ORT	pumping, purified water.	+	elect
2 food preparation	sanitation, hygiene.	-	purified (boiled) water.	1	any
3 purification	household water.	-	-	+	elect
4 water borne/ washed/based	sanitation.	health services	household water, hygiene, boiled water.	+	any
5 toxins in water supply	purification.	health services	boiled water?	1+	any
Food/Nutrition related:					
1 malnutrition	nutritional interventions.	health services	-	+	-
2 food poisoning	appropriate storage appliances.	health services	refrigeration	1	elect/gas
3 cooking	(hot) household water.	-	-	1+	any
4 diarrhoea	hygiene.	ORT	purified (boiled) water	1+	any
Agriculture related:					
1 pesticides	-	health services	-		-
2 water-borne irrigation	-	health services	-		-
3 machinery injuries	-	health services	-		-
Viruses	vaccine	health services	cold storage	1	elect/gas
Cancers (?)	improved environmental health	health services	overhead voltage lines?	1?	-
HIV/AIDS	education. reproductive health services.	health services health services	education rural developmnt?	?	elect
STDs	education. changed migration?	health services	cold storage - vaccines rural developmnt?	1 +?	elect/gas elect?

Table 11: Energy requirements of some preventative and curative interventions in selected illnesses

** - ED: Energy Directness - see text for an explanation*

It is important to note that the energy data presented below are tentative and assume that all other necessary conditions have been met. For example, prevention of diarrhoeal disease at the level of the household requires that, among other things, there is sufficient food of an

adequate nature, that food preparation practices and breast-feeding are hygienic, and that there is social support for women with young children. The curative intervention, ORT (Oral Rehydration Therapy), requires purified (boiled) water, which in turn requires an efficient energy source. It should be noted, however, that the most important intervention in diarrhoeal disease is preventative rather than curative. The energy flow thus is less direct for preventative practices - energy is required to pump water to houses, etc., and tends to be direct only in the curative aspects of the intervention.

It should be noted that there are many decision-making steps between a patient and either a clinic or a hospital, and that patients may seek other healing sources rather than or alongside biomedicine (see Helman, 1990)[15]. Given the scope of the current project, we concentrate on services provided by clinics, but it should be remembered that biomedicine is only one of a range of health interventions.

In Table 11, we see that once illness takes hold and a decision is made to utilise biomedical resources, clinics are important in mediating health. We turn now therefore to focus on the specific energy needs of biomedical health services. We take rural clinics as the locus of discussion and examine the energy-related services required by clinics and their staff. The discussion of equipment is drawn from the list of Essential Equipment utilised by the Planning Directorate of the Department of Health in the planning of modular units. It should be noted that this listing assumes that electricity will be in place in the clinics. In the latter half of the discussion we focus on the vaccine cold-chain as a case study, in order to explore the relative importance of energy in improving health through vaccination programmes.

Energy and Clinics

The Department of Health's Essential Equipment list indicates that all clinics (two to six consulting rooms), including those that are expected to double as recreation/education centres and community halls, should be stocked with fans and heaters in each room. In addition, there should be a staff fridge and kettle in the clinic. Rooms where medical examinations and procedures are to be carried out should have at the minimum:

- a steriliser. This is either of the autoclave or boiler type.
- a vaccine storage fridge. The fridge should be fitted with a thermometer and thermostat, and staff should be trained in reading and maintaining the fridges.
- medical lamps - preferably 150 watt.
- a resuscitation set, used to revive patients in cardiac arrest. The set may be battery-operated.
- a suction machine, used to clear the lungs of mucus. The machine may be vacuum-operated, or foot-pump operated, or mechanical or may be electrical.

Neo-natal or maternal clinics in rural areas deal with uncomplicated births. Their energy needs therefore do not extend as far as requiring reliable energy for incubators. However, these clinics should be supplied with reliable lighting (150 watts) for use during suturing. The mobile theatre lights used can utilise either a mains source or batteries.

The Essential Equipment List also indicates that larger clinics and those that double as community centres should be equipped with TV/VCR sets for educational purposes. Such sets could be battery or generator-powered. Not mentioned on the listing is the need for reliable contact between the clinic and its district hospital using either conventional or radio telephones. The listing also does not make mention of geysers.

Use patterns of the equipment summarised above are dependent on clinic opening times, and on whether the clinic is provided with an emergency facility. The fact that the times at

15 Helman describes the many sources from which advice pertaining to ill-health is sought. He notes that health-seeking behaviour depends on the interpretation of illnesses, the contexts in which it occurs and the availability of public knowledge about the etiology of the affliction. He shows also that interventions depend on the kinds of healer available and expectations of their efficacy in healing that particular illness. The success of illness interventions depends also on costs and on the length of the intervention. It should not be presumed that there is a direct and linear relationship between the onset of illness and the arrival at a biomedical clinic of a patient.

which equipment will be used is not predictable means that ideally the energy source used to power clinic equipment should be reliable throughout the period that the clinic is open. This is especially true for clinics offering a neo-natal service. In addition, where clinics do not offer a 24 hour service, they should be equipped with reliable communications networks so that in emergencies appropriate action can be taken.

Many clinics do not offer a 24 hour service because the buildings are not supplied with either adequate lighting or adequate security to make such a service possible (Ward, 1993). The implication is that no 24 hour or emergency service can be offered in areas where there is not a reliable source of lighting. Provision of lighting also ameliorates security conditions in addition to making longer opening hours or emergency services available. In the current context it seems that the services offered by clinics are driven more by the resources that they have available (e.g. adequate lighting) than by a vision of what services should be offered by rural clinics. In part the discrepancy may arise from the disproportionate role in clinic-building decision-making taken by the IDT in the past.

It should not however, be assumed that the installation of electricity in rural clinics will automatically improve the services that clinics are able to offer, or that the health of rural populations will improve measurably as a direct result. Numerous factors intervene between the provision of technologies and the attainment of the goals for which they were introduced. We have used the vaccine cold-chain as an example throughout this paper. Below we discuss the cold-chain in more detail as a case study to indicate the complexity of factors that are brought to bear on the promotion of child health through the vaccination programme that partially underlies notions of PHC.

Benade's (1996) examination of the vaccine cold chain in the Western Cape suggests that whilst ensuring the maintenance of the cold chain is necessary to the efficacy of any vaccination programme, there are several other features of as much if not greater importance in ensuring that the vaccination programme is effective. Benade makes three essential points for our argument. The first has to do with human behaviours. He suggests that one of the greatest difficulties encountered in the vaccination programme is that of ensuring that mothers bring their children back to clinics to complete their vaccination series. Failure to do so means that children are not adequately protected and may be worse-off than if they had not been vaccinated at all. Incomplete vaccine treatment may also lead to the production of drug-resistant diseases. Benade also points out that where staff in clinics are not properly trained in vaccine storage, vaccines may be opened and not used prior to their expiry dates, or may be incorrectly stored. His second point has to do with the relationships between equipment, its maintenance and human behaviours. Fridges in which vaccines are stored may not be properly equipped with thermometers. Where they are so equipped, nurses may not be trained to read thermometers, or may not read them regularly. In addition, storage of private foodstuffs etc. in fridges means that the fridges are opened frequently, thus further compromising the cold-chain as cold air escapes. In short, his study shows that provision of adequate energy in the cold-chain (his third point) is not a guarantee that a vaccination programme will be effective. His work suggests that the vaccination programme is most fragile at the points of human interaction rather than solely in the technical implementation of the cold-chain process as has previously been implied.

Benade's study is used here as an example of the factors that play important roles in the provision of health at a clinic level. It shows that human behaviours are more likely to prejudice the efficacy of the vaccination programme than is the failure of the cold-chain. It shows also that the technical components of the programme are only effective insofar as equipment is adequately maintained, and the people who are implementing the programme are well-trained and have adequate facilities for their own use. It is to the latter that we now turn.

Energy and Staff in Rural Clinics

Ward (1993) has indicated that it difficult to attract and retain trained staff in rural areas, in part because the facilities that are offered for staff are perceived as being inadequate or inferior. This is exacerbated in contexts where there is a very high crime or violence rate. Nurses have commented that they wish to have better security, outside lights, household electrification and better telephone contact in rural areas (*ibid.*; HCO, 1995). There are suggestions that nurses homes attached to those clinics connected to the grid should be

electrified as a matter of course in order to attract staff to rural clinics. The Essential Equipment listing quoted above takes electrification of staff quarters as a given: it states that staff quarters should be provided with a kettle, iron, a stove (included in the building contract) and a fridge. There is no mention of geysers in the document.

While electrification of nurses homes is a good idea in principle, it is difficult to see how providing electricity at a household level for staff can be considered equitable if the remainder of households in the region are not also electrified. Also, the argument for the provision of electricity in staff quarters tends to suggest that if electricity was provided then staff would be more prepared to remain in rural areas. It is not likely that there is such a direct relationship between electrification and reduced attrition rates, and it is also not likely that electrification (or the lack of it) alone can account for high rates of staff mobility. There is no doubt that staff perceive the lack of basic amenities (including the lack of electricity, but also including inadequate housing, insufficient water, isolation, difficult or demanding working conditions, etc.) as negative, but it would not be wise to assume that electrification *per se* will ameliorate the working and living conditions with which rural health workers have to deal.

7 Conclusions and Recommendations

The final caution above seems an appropriate warning for proponents of RE. A critical review of the literature illustrates that the health of rural populations is contingent on a number of factors, of which rural electrification is only one. We have argued that notwithstanding the critiques of RE, it serves an important role in promoting health, but that its role is both limited and indirect. For example, it is likely that RE will have a more immediate health effect at a household level, as when it enables the provision of water and sanitation at a household level than when it is directed at reducing domestic air pollution rates. Low uptake rates where alternative fuels exist and where appliances are costly are likely to continue to characterise the household consumption patterns of poorer populations, particularly in rural areas. Low conversion rates are likely to limit the positive effects on health that electrification could offer, particularly those benefits that are linked to air pollution reduction. In addition, if the clinic modules and equipment proposed by the Planning Directorate of the Department of Health are utilised in their current form, then it is clear that while electricity will be important in clinics, it is not a necessary condition to ensuring that effective health services are offered, as most of the equipment is not reliant on electricity.

We have argued in this report that health is a product of an interaction between infrastructures and behaviours, and that the provision of reliable and adequate energy sources is an important infrastructural component of any rural development plan. The health plan envisaged by the Department of Health focuses on interventions at the level of clinics, rather than households. In this context, clinic electrification is not sufficient as a health intervention on its own. We have also suggested that the success of a rural electrification program is dependent on co-ordinated implementation. It is clear that in the South African context, institutional relationships both in the past and the present have resulted in a health plan that tends to prioritise curative health, even within the preventative health paradigm. The services that the Department of Health are able to offer are further constrained by institutional arrangements that have not and do not encourage cohesive planning between the Department and other role players.

Institutional relations between the Department of Health and key role-players hold the key to the development of appropriate infrastructure. However, developmental effectiveness is also reliant on the involvement and acceptance of interest groups within the target communities. Energy development within the health sector appears to be largely supply rather than demand-driven, with the effect that there appears to be little sustained interaction at a community level between the utilities, agencies and community representatives. This is complicated by poor administrative capacity at a ward/village level, as local government functions are not always decentralised.

An important recommendation that emerges from the discussion above is that the Department of Health formulate national policy that clearly envisages the role of electrification in health amelioration. In this way it will be better equipped both to drive

and to take ownership of the current clinic-building process. It is equally clear that as provinces are given increasing autonomy over decision-making and budgetary control, the processes through which clinics are built will be handled at regional and provincial level, as we have already seen happening in the Northern Province and KwaZulu-Natal. It is likely that health requirements in different provinces, and even different regions of provinces will differ from one another and will also change over time. Any formalisation of relations between stakeholders should therefore take cognisance of the differences in provincial profiles whilst at the same time ensuring that national priorities receive attention in provincial plans and budgets. In order to drive an effective health process, clear liaisons between stakeholders should be generated at the level of provincial government, in consultation with regional representatives who are linked with local organisations.

This study indicates that over the long term electrification can have both direct and indirect health benefits, when implemented as part of a co-ordinated, sustained, community-based programme of rural development. It is equally clear that in the current South African context, formalised interaction between key role-players among the institutions involved in the provision of health services is not driven by a cohesive planning programme that prioritises specific kinds of health intervention and services to be offered to rural dwellers. Given that the White Paper on Health has yet to be passed into law, a further recommendation that flows from this report is that future research be undertaken to examine the effects of the Act on health planning and service provision.

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